Reg. No. : ....

Name : ....

II Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Supplementary/ Improvement) Examination, April 2025

(2019 to 2023 Admissions)

COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS

2C02 MAT-CH : Mathematics for Chemistry – II

Time : 3 Hours

Max. Marks : 40

UNIT – I

Short answer type. Answer **any 4** questions. **Each question carries 1 mark.** (4×1=4)

1. Find the natural domain of the function $z = \sqrt{3x^2 + 5y^2}$.

2. Find the degree of the homogeneous function $f(x, y) = \dfrac{\sqrt{y} + \sqrt{x}}{y + x}$.

3. Evaluate $\int \cos^5 x\, dx$.

4. Define a line in polar co-ordinates.
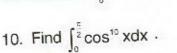
5. Define Similar Matrices.

UNIT – II

Short essay type. Answer **any 7** questions. **Each question carries 2 marks.** (7×2=14)

6. Check the continuity of the function $f(x, y) = \dfrac{x + y}{x - y}$.

7. If $u = \sin^{-1}\left(\dfrac{x^3 - y^3}{x + y}\right)$, show that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = 2\tan u$.

8. Use the chain rule to find the derivative of $w = xy$ with respect to θ along the path $x = \cos\theta$, $y = \sin\theta$. What is the derivatives value at $\theta = \dfrac{\pi}{2}$?

P.T.O.

9. Evaluate $\displaystyle\int_0^{\pi/6} \sin^4 3x\, dx$.

10. Find $\displaystyle\int_0^{\pi} \cos^{10} x\, dx$.

11. Evaluate $\displaystyle\int_{-1}^{2} (x^4 - 4x^2 + 6)\, dx$.

12. Find the average value of $z = f(x, y) = x\cos xy$ over the rectangle
    $R : 0 \le x \le \pi, \ 0 \le y \le 1$.

13. State Cayley-Hamilton Theorem.

14. Find the eigen values of the matrix $A = \begin{bmatrix} 10 & 3 \\ 4 & 6 \end{bmatrix}$.

15. Give the matrix associated with the quadratic form
    $6x_1^2 + 17x_2^2 + 3x_3^2 + 2x_1x_3 + 14x_2x_3 + 20x_1x_2$.

UNIT – III

Essay type. Answer **any 4** questions. **Each question carries 3 marks.** (4×3=12)

16. Describe the graph of the function $f(x, y) = 1 - x - y$.

17. Evaluate $\displaystyle\int_0^a \dfrac{x^4\, dx}{\sqrt{a^2 - x^2}}$.

18. Find the value of $\displaystyle\int_0^{\pi/2} \cos^3 x \cos 2x\, dx$.

19. Find the volume of the solid generated by revolving the region bounded by $y = \sqrt{x}$ and the lines $y = 1$, $x = 4$ about the line $y = 1$.

20. Find the polar equivalent of the curve whose Cartesian equation is $x^2 - y^2 = 1$.

21. Find the eigen values and corresponding eigen vectors of $A = \begin{bmatrix} 1 & 1 & 2 \\ 0 & 2 & 2 \\ -1 & 1 & 3 \end{bmatrix}$.

22. Prove the eigen values of a triangular matrix are the same as its diagonal elements.

UNIT – IV

Long essay type. Answer **any 2** questions. **Each question carries 5 marks.** (2×5=10)

23. If $v = (x^2 + y^2 + z^2)^{-1/2}$, prove that $\dfrac{\partial^2 v}{\partial x^2} + \dfrac{\partial^2 v}{\partial y^2} + \dfrac{\partial^2 v}{\partial z^2} = 0$.

24. Prove that $\displaystyle\int_0^1 x^{3/2}(1 - x)^{3/2}\, dx = \dfrac{3\pi}{128}$.

25. Evaluate $\displaystyle\int_1^3 \int_1^2 \int_0^{xy} xyz\, dz\, dy\, dx$.

26. If $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$ find A^2 using Cayley Hamilton theorem and then find A^3.